

WHAT IS CLAIMED:

1. A method of mapping irregularities in a surface of a hard tissue within a target, the method comprising:

- (a) transmitting from an ultrasonic transducer at a defined location a focused beam of ultrasonic energy towards the surface of the hard tissue at a first oblique angle of incidence;
- (b) registering said defined location if and only if an echo-reflection from said surface of the hard tissue is received by said transducer;
- (c) defining said location of said transducer in six degrees of freedom;
- (d) calculating a set of position co-ordinates for a portion of the surface of the hard tissue causing said echo-reflection;
- (e) moving said ultrasonic transducer to a different defined location;
- (f) repeating a through e;
- (g) repeating steps (a) through (f) with an additional angle at least 20 degrees apart from the previous oblique angle;
- (h) determining for each of said set of position co-ordinates for a portion of the surface of the hard tissue causing said echo-reflection at least a portion of a reflection diagram;
- (i) further determining for each of said at least a portion of a reflection diagram a degree of normalcy according to a predetermined rule to generate a map of the irregularities in the surface of the tissue;
- (j) classifying any of said set of position co-ordinates for a portion of the surface of the hard tissue wherein said at least a portion of a reflection diagram is characterized by a low degree of normalcy according to said predetermined rule as belonging to a surface irregularity; and
- (k) compiling at least a portion of said sets of position co-ordinates to generate a map of the irregularities in the surface of the hard tissue .

2. The method of claim 1, wherein said repeating includes adjusting said angle of incidence to at least one second angle of incidence.

3. The method of claim 1, further comprising:
 - (l) displaying upon a display device at least one item selected from the group consisting of:
 - (i) data pertaining to said echo-reflection;
 - (ii) said set of position co-ordinates for said portion of the surface of the hard tissue causing said echo-reflection; and
 - (iii) at least a portion of said map.
4. The method of claim 1, further comprising:
 - (l) controlling, by means of a central processing unit, performance of at least a portion of the method.
5. The method of claim 2, further comprising:
 - (i) controlling, by means of a central processing unit, performance of at least a portion of the method.
6. The method of claim 5, wherein said controlling includes at least one item selected from the group consisting of said adjusting and said registering.
7. The method of claim 6, wherein said controlling indicates at least one control mechanism selected from the group consisting of mechanical control, selection from an array and electronic control.
8. The method of claim 1, wherein at least one item selected from the group consisting of said adjusting and said registering is performed manually by a practitioner of the method.
9. The method of claim 1, wherein said map is a two dimensional map.
10. A system for mapping irregularities in a surface of a hard tissue within a target, the system comprising:

- (a) at least one ultrasonic transducer:
 - (i) said at least one transducer positioned at a defined location;
 - (ii) said at least one transducer capable of transmitting a focused beam of ultrasonic energy towards the surface of the hard tissue at a first angle of incidence;
 - (iii) said at least one transducer capable of receiving at least a portion of said energy as an echo-reflection from the surface of the hard tissue; and
 - (iv) said at least one transducer capable of communication with a central processing unit;
- (b) a position locator and adjustment mechanism operably connectable to said at least one transducer and designed and constructed ;
 - (i) to be capable of adjusting said angle of incidence between said focused beam and the surface of the hard tissue in response to a command from said central processing unit;
 - (ii) to be further capable of defining said location of said transducer as a set of position co-ordinates in six degrees of freedom and transmitting said set of co-ordinates to a central processing unit;
 - (iii) to be further capable of moving said at least one ultrasonic transducer to a series of different defined location;
- (c) said central processing unit designed and configured;
 - (i) to be further capable of receiving said set of position co-ordinates defining said location of said at least one transducer from said position locator and adjustment mechanism;
 - (ii) to be further capable of calculating an additional set of position co-ordinates for a portion of the surface of the hard tissue causing said echo-reflection;
 - (iii) to be further capable of compiling a plurality of said sets of position co-ordinates to generate a map of the surface of the hard tissue.

11. The system of claim 10, further comprising a:

- (d) a display device capable of communication with said central processor; said display device designed and constructed to perform at least one function selected from the group consisting of :
 - (i) display data pertaining to said echo-reflection;

- (ii) display said additional set of position co-ordinates for a portion of the surface of the hard tissue causing said echo-reflection; and
- (iii) display at least a portion of said map.

12. The system of claim 10, wherein said central processing unit is further designed and constructed to be capable of transmitting a command to said position locator and adjustment mechanism to cause said at least one transducer to move to said series of different defined locations;

13. The system of claim 12, wherein said command is selected from the group consisting of a command to a mechanical control, a command to switch to a different transducer of said at least one transducer and a command to an electronic control.

14. The system of claim 10, wherein said position locator and adjustment mechanism is designed and configured to receive input from an operator of the system, said input being selected from the group consisting of a manual position adjustment by an operator of the system and at least one instruction transmitted to said central processing unit by said operator.

15. The system of claim 10, wherein said map is a two dimensional map.